DOCUMENT RESUME

ED 194 333 SE 033 160

AUTHOR Reddy, Jean: And Others
TITLE Algebra I Curriculum Guide. Bulletin 1580.
INSTITUTION Louisiana State Dept. of Education, Baton Rouge. Div. of Academic Programs.
PUB DATE 80
NOTE 79p.: For related documents, see SE 033 159-163. Contains occasional light type.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Algebra: Cognitive Objectives: Educational Objectives: *Mathematics Instruction: Program Descriptions: Resource Materials: Secondary Education: *Secondary School Mathematics: *State Curriculum Guides: Teaching Methods

ABSTRACT

This Algebra I curriculum guide, produced under the direction of the State of Louisiana Department of Public Education, is a segment of the educational program established in response to accountability, assessment, and competency-based education laws. This guide is designed to represent the best thinking of a selected statewide committee established to determine the scope of mathematics content for a first-year course in algebra at the secondary school level. The guide contains: (1) the membership rosters of the committees involved in development of the material; (2) a review of the curriculum development process; (3) six required goals that students completing Algebra I should be able to reach; (4) a complete curriculum outline with performance objectives; and (5) a detailed set of activities grouped with specific objectives and content areas of the Algebra I program. (MP)

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ALGEBRA I

CURRICULUM GUIDE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Louisiana State Department of Education

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SE 033 160

This public document was published at a cost of $3.64 per copy by the Department of Education, Post Office Box 44064, Baton Rouge, Louisiana 70804, to provide information to Louisiana educators, under authority of special exception by the Division of Administration. This material was printed in accordance with the standards for printing by State agencies established pursuant to R.S. 43:31.

DEPARTMENT OF PUBLIC EDUCATION
STATE OF LOUISIANA

Bulletin 1580
1980

ALGEBRA I CURRICULUM GUIDE

Issued by
Division of Academic Programs

J. KELLY NIX
State Superintendent

NOV 7 1980

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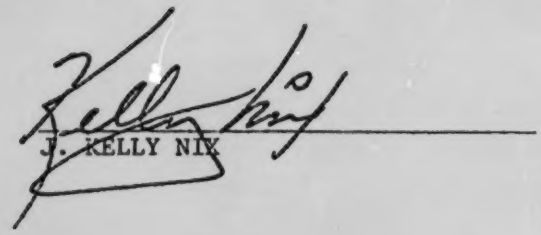
FOREWORD

Curriculum guides have been developed for each mathematics course at the secondary level and for grades K-8 at the elementary level. These guides represent the best thinking of a selected statewide committee established to determine the scope of mathematics content which should be taught at each level.

The mathematics curriculum guides are another segment of the total educational program established by this administration and mandated by the Legislature in both the accountability and assessment and the competency-based education laws. This educational program requires that specific skills and concepts be established for each grade level and for each subject area. The mathematics curriculum guides with course outlines, performance objectives and coordinated activities effect this phase of the program.

It is hoped that the guides will make a major contribution to the improvement of mathematics instruction in the schools of Louisiana. This is another step toward achieving the goals of this administration.

FOR OUR CHILDREN



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ACKNOWLEDGMENTS

The statewide mathematics committee is to be commended for its work in the development of the Mathematics Curriculum Guides K-12. The committee worked under the chairmanship of Dr. Jean Reddy, Section Chief of the Mathematics Section in the Bureau of Secondary Education.

The Bureaus of Elementary Education and Secondary Education were responsible for writing the activities component of the Mathematics Curriculum Guides. The elementary supervisors in the Bureau of Elementary Education with Mrs. Bonnie Ross serving as chairman of the committee, developed the activities for the K-8 guide. The activities for the secondary guides were drafted by a committee under the leadership of Dr. Jean Reddy. These people are to be commended for their colossal accomplishments in this formidable project.

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INTRODUCTION

Act 750 of the 1979 Louisiana Legislature established the Louisiana Competency-Based Education Program. One of the most important provisions of Act 750 is the mandated "development and establishment of statewide curriculum standards for required subjects for the public elementary and secondary schools of this state...." The "statewide curriculum standards for required subjects" is defined as "the required subjects to be taught, curriculum guides which contain mimimum skills and competencies, suggested activities, suggested materials of instruction, and minimum required time allotments for instruction in all subjects." Act 750 further provides that the "effective implementation date of the statewide curriculum standards for required subjects shall be the 1981-82 school year. Development of such curriculum shall begin by the 1979-80 school year."

During the 1978-79 school year, curriculum guides were developed by advisory and writing committees representing all levels of professional education and all geographic areas across the State of Louisiana for the following mathematics courses:

> Algebra I, Algebra II, Geometry, Advanced Mathematics, and Trigonometry.

The major thrust of the curriculum development process in each of the guides has been the establishment of minimum standards for student achievement. Learning expectancies for mastery have been determined for each course and/or grade level. In addition, content outlines, suggested activities, procedures, and bibliographies have been developed as aids in support of the learning expectancies. The curriculum guides also contain activities designed to stimulate learning for those students capable of progressing beyond the minimums.

During the 1979-80 school year, the curriculum guides were piloted by teachers in school systems representing the different geographic areas of the state as well as urban, suburban, inner-city, and rural schools. The standard populations involved in the piloting reflected also the ethnic composition of Louisiana's student population. Participants involved in the piloting studies utilized the curriculum guides to determine the effectiveness of the materials that were developed. Based upon the participants' recommendations at the close of the 1979-80 pilot study, revisions were made in the curriculum guides to ensure that they are usable, appropriate, accurate, comprehensive, relevant, and clear.

The curriculum guides are now ready for full program implementation. This stage must be understood in its operational context. The curriculum developers and the participants in the pilot studies do not stand alone in promoting learning expectancies that will improve education for the students in the State of Louisiana. Ultimately, local system supervisors, principals, and classroom teachers will have the responsibility for attaining this goal.

As curriculum guides are implemented, the following guidelines should prove helpful:

> ...curriculum standards should be considered as the foundation for the year's instructional program. Where other programs are already in operation, these curricular materials must be checked with the foundation curricula to ensure that appropriate course and/or grade level standards are included and maintained.

...curricular activities contained in the guides provide a number of suggestions for helping students to achieve the established standards. Activities to meet the needs of "average," "below average," and "above average" students have been included. These activities should prove helpful as the teacher plans and organizes instruction. Additional activities, however, may supplement or be used in lieu of those listed in the guide as long as these activities are designed to achieve similar specific objectives.

...curricular suggestions for meeting the needs of the special child have been prepared by the Division of Special Education. These suggestions are designed to provide help for teachers who work with special children in the regular classroom.

The continued effort of mathematics teachers to provide quality instruction will enhance our statewide goal to ensure that every student in the public elementary and secondary schools of the State of Louisiana has an opportunity to attain and to maintain skills that are considered essential to functioning effectively in society.

J. KELLY NIX
State Superintendent of Education

GOALS

Upon completion of a first course in Algebra, the student will be able to:

1. Understand the basic structure of algebra.
2. Perform operations with real numbers and algebraic expressions.
3. Identify the solution set of linear and quadratic equations and inequalities.
4. Acquire a basic knowledge of coordinate geometry.
5. Perform multiple operations with polynomials.
6. Acquire skills in simplifying radicals.

PACING CHART

The following pacing chart contains suggested periods of time to devote to each major topic in the mandatory portion of this curriculum guide. Since students learn at different rates and days are lost during the school year for various reasons, this pacing chart is based on 32 weeks of school. This provides four weeks of school to utilize as "pad" time in allowing for the factors affecting pacing. Should a group of students complete the mandatory material prior to the end of school, this guide provides ample optional and supplemental material to use as enrichment.

	TOPIC	NUMBER OF WEEKS
I.	Language of mathematics	1
II.	Operations on real numbers	3
III.	Language of algebra	5
IV.	First degree equations and inequalities in one variable	5
V.	Polynomials	4
VI.	Factoring monomials	1
VII.	Multiplication and factoring of polynomials	4
VIII.	Fractions	5
IX.	Squaring and square roots	1
X.	Linear equations and inequalities	3
XI.	Relations and functions	(Time permitting)
XII.	Real numbers, radicals, and quadratics	(Time permitting)

CURRICULUM OUTLINE AND PERFORMANCE OBJECTIVES

NOTE: All items are mandatory unless preceded by an asterisk. All items with an asterisk should be taught if time permits (See Pacing Chart).

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
I. Language of Mathematics	
A. Identification of symbols	A. To develop an understanding of the language of mathematics, the student will be able to identify mathematical symbols: +, −, ×, ÷, <, >, etc. . .
B. Set of real numbers	B. To develop an understanding of real numbers, the student will be able to:
1. Definition	1. Define and identify real numbers;
2. Subsets	2. Identify subsets of real numbers.
C. Number line	C. To demonstrate an understanding of a number line, the student will be able to:
1. Construction	1. Construct a number line and:
a. Coordinate of a point	a. Assign a number to a designated point
b. Graph of a number	b. Assign a point to a designated number
2. Graphs of subsets	2. Graph various subsets of the real numbers;
3. Compare real numbers	3. Compare any two real numbers;
4. Absolute value	4. Define and determine the absolute value of any real number.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
II. Operations on Real Numbers	
A. Order of operations	A. To demonstrate an understanding of operations on real numbers, the student will be able to:
1. Without grouping symbols	1. Perform multiple operations without grouping symbols;
2. With grouping symbols	2. Perform multiple operations with grouping symbols.
B. Addition of real numbers	B. To develop an understanding of operations on real numbers, the student will be able to:
1. Number line	1. Use a number line to add real numbers;
2. Rules	2. Use the rules for adding real numbers.
C. Subtraction of real numbers	C. To develop an understanding of operations on real numbers, the student will be able to subtract real numbers by using the definition of subtraction.
D. Multiplication of real numbers	D. To develop an understanding of the operations on real numbers, the student will be able to multiply real numbers.
E. Division of real numbers	E. To develop an understanding of operations on real numbers, the student will be able to divide real numbers.
F. Axioms of real numbers	F. To develop an understanding of operations on real numbers, the student will be able to recognize and use: 1. Axioms of closure; 2. Commutative axiom; 3. Associative axioms; 4. Additive axiom of zero; 5. Axiom of opposites; 6. Axiom of an opposite of a sum; 7. Distributive axiom; 8. Multiplicative axiom of 1; 9. Multiplicative axiom of 0; 10. Multiplicative axiom of -1; 11. Axiom of opposites in products 12. Axiom of reciprocals.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
III. Language of Algebra	
A. Algebraic expressions	A. To demonstrate an understanding of algebraic expressions, the student will be able to:
1. Definitions and identifications	1. Define and identify the mathematical terms: a. Constant b. Variable c. Base d. Exponent e. Coefficient f. Factor g. Term h. Algebraic expressions
2. Evaluation	2. Evaluate algebraic expressions.
B. Linear questions	B. To demonstrate an understanding of linear equations, the student will be able to:
1. Definitions and identification	1. Define and identify the mathematical terms: a. Equation b. Open sentence c. Replacement set d. Root e. Solution set f. Member of an equation g. Linear equation

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Language of Algebra (Continued)	
2. Axiom of equality	2. Use of reflexive, symmetric and transitive axioms;
3. Other properties of equality	3. Use: a. Substitution property of equality b. Addition property of equality c. Subtraction property of equality d. Multiplication property of equality e. Division property of equality
4. Solving linear equations in one variable	4. Use the properties of equality to solve linear equations in one variable;
*5. Solving compound sentences	*5. Use the properties of equality to solve compound sentences that involve absolute value.
C. Linear inequalities	C. To develop an understanding of linear inequalities, the student will be able to:
1. Definition	1. Define and identify a linear inequality;
2. Properties	2. Use: a. Trichotomy property (axiom of comparison); b. Transitive property of inequalities; d. Substraction property of inequalities; e. Multiplication property of inequalities; f. Division properties of inequalities.

*Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Language of Algebra (Continued)	
3. Solving linear inequalities in one variable	3. Use the properties of inequalities to solve linear inequalities;
4. Graphs	4. Graph the solution set of linear inequalities;
5. Compound sentences	5. Solve compound sentences that involve linear inequalities and:
a. Without absolute value	a. That do not involve absolute value
*b. With absolute value	*b. That do involve absolute value
6. Graphs of compound sentences	6. Graph the solution set of compound sentences that involve linear inequalities and:
a. Without absolute value	a. That do not involve absolute value
*b. With absolute value	*b. That do involve absolute value

*Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
IV. First Degree Equations And Inequities In One Variable	
A. Linear equations	A. To demonstrate an understanding of linear equations, the student will be able to solve equations that have variables in both members of the equation.
B. Inequalities in one variable	B. To demonstrate an understanding of inequalities in one variable, the student will be able to solve inequalities that contain variables in both members of the inequality.
C. Translation	C. Translate verbal expressions to algebraic expressions and algebraic expressions to verbal expressions.
D. Applications	D. To demonstrate an understanding of linear equations, the student will be able to use linear equations to solve problems that involve number relations. 1. Number problems; 2. Consecutive integer problems; 3. Geometry problems; *4. Distance problems; *5. Coin problems; *6. Age problems.

* Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
V. Polynomials	
A. Introduction to polynomials	A. To develop an understanding of polynomials, the student will be able to:
1. Definition and identification	1. Define and identify the listed mathematical terms:
	a. Monomial
	b. Binomial
	c. Trinomial
	d. Polynomial
	e. Degree of a polynomial
2. Arrangement of terms	2. Write the terms of a polynomial in descending or ascending order.
B. Operations on polynomials	B. To demonstrate an understanding of operations on polynomials, the student will be able to:
1. Addition	1. Add polynomials by combining similar terms;
2. Subtraction	2. Subtract polynomials by combining similar terms;
3. Laws of exponents (multiplication)	3. Use the laws of exponents to find the product of :
a. Two or more monomials	a. Two or more monomials
b. Polynomial by a monomial	b. A polynomial by a monomial
c. Two polynomials	c. Two polynomials

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Polynomials (Continued)	
4. Laws of exponents (division)	4. Use the laws of exponents to divide:
a. Monomials	a. Two monomials
b. Polynomial by a monomial	b. A polynomial by a monomial
c. Polynomials	c. Two polynomials
5. Laws of exponents (Zero and Negative exponents)	5. Use the laws of exponents to write equivalent expressions for monomials with a zero or negative exponent.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VI. Factoring Monomials	
A. Prime factors of integers	A. To demonstrate an understanding of factoring, the student will be able to define and find the prime factors of two or more integers.
B. Greatest common factor	B. To demonstrate an understanding of factoring, the student will be able to find the greatest common factor:
1. Numerical expressions	1. Numerical expressions;
2. Monomials	2. Monomials.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VII. Multiplication And Factoring Of Polynomials	
A. Multiplying by sight	A. To demonstrate an understanding of multiplying binomials, the student will be able to multiply by sight.
B. Factoring	B. To demonstrate an understanding of factoring, the student will be able to factor special types of polynomials.
	1. Greatest monomial factor of a polynomial;
	2. Difference of two squares;
	3. Trinomial square;
	4. General method of factoring quadratic trinomials;
	5. Combinations of all the above.
C. Quadratic equations	C. To demonstrate an understanding of factoring, the student will be able to:
1. Solutions by factoring	1. Solve quadratic equations by factoring;
*2. Applications	*2. Solve verbal problems by using and factoring quadratic equations.

*Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VIII. Fractions	
A. Common fractions	A. To demonstrate an understanding of fractions, the student will be able to perform fundamental operations on common fractions.
B. Algebraic fractions	B. To demonstrate an understanding of fractions, the student will be able to:
1. Definition	1. Define an algebraic fraction;
2. Restricted values	2. Determine the restricted value of an algebraic fraction;
3. Reducing fractions	3. Reduce algebraic fractions;
4. Multiplication	4. Find the product of two or more algebraic fractions;
5. Division	5. Find the quotient of two or more algebraic fractions;
6. Least common multiple	6. Find the least common multiple of two or more algebraic expressions;
7. Combining fractions	7. Combine fractions by addition and subtraction;
*8. Mixed expressions	*8. Simplify mixed expressions by adding a polynomial and a fraction;
*9. Complex fractions	*9. Simplify complex fractions.
C. Fractional equations	C. To demonstrate an understanding of fractions and fractional equations, the student will be able to solve first degree fractional equations.
*D. Fractional inequalities	*D. To demonstrate an understanding of fractions and fractional inequalities, the student will be able to solve first degree fractional inequalities.

*Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
IX. Introduction and Factoring of Polynomials	
A. Terminology	A. To demonstrate an understanding of squares and square roots, the student will be able to define and/or identify the listed mathematical terms.
1. Terminating decimals	
2. Repeating decimals	
3. Rational numbers	
4. Irrational numbers	
5. Principal square root	
B. Squares (numerals and variables)	B. To demonstrate an understanding of squares, the student will be able to find the squares of numerals and variables.
C. Square roots	C. To demonstrate an understanding of square roots, the student will be able to:
1. Square roots of perfect squares (numerals and variables)	1. Find the square root of a perfect square;
2. Square roots of monomials	2. Simplify monomial square roots.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
X. Linear Equations and Inequalities	
A. Terminology	A. To develop an understanding of linear equations and inequalities, the student will be able to identify the listed mathematical terms.
1. Rectangular coordinate system	
2. Ordered pair	
3. Horizontal axis	
4. Vertical axis	
5. Origin	
6. Quadrants	
7. Abscissa	
8. Ordinate	
9. Graph of a linear equation	
10. Graph of a linear inequality	
11. x intercept	
12. y intercept	
13. Slope of a line	
14. System of equations	
B. Graphing	B. To develop an understanding of the graph of a line, the student will be able to:
1. Location of points	1. Locate and relate points in a plane to ordered pairs of numbers;
2. Linear equations	2. Graph linear equations in two variables;
3. Linear inequalities	3. Graph linear inequalities in two variables.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Linear Equations and Inequalities (Continued)	
C. Slope of a line (computation)	C. To develop a basic understanding of slopes of lines, the student will be able to find the slope of a line given:
1. Graphing	1. The graph of a line;
2. Coordinates of two points	2. The coordinates of two points of a line;
3. Equation of line	3. An equation of the line.
D. Equations of a line	D. To develop an understanding of equations of lines, the student will be able to write linear equations in:
1. Slope-intercept form	1. Slope-intercept form;
2. Point-slope form	2. Point-slope form.
E. Systems of linear equations	E. To develop an understanding of systems of linear equations, the student will be able to:
1. Graphing	1. Solve systems of equations by graphing;
2. Linear-combination	2. Solve systems of equations by the addition and subtraction method;
3. Substitution method	3. Solve systems of equations by the substitution method;
*4. Applications	*4. Solve verbal problems by using systems of linear equations.
*F. Systems of linear inequalities (graphing)	*F. To develop an understanding of linear inequalities, the student will be able to determine the solution set of systems of linear inequalities by graphing.

*Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
*XI. Relations and Functions	
*A. Relations	*A. To demonstrate an understanding of relations, the student will be able to:
1. Definition	1. Define a relation;
2. Domain	2. Define and/or determine the domain of a relation;
3. Range	3. Determine the range of a relation.
*B. Functions	*B. To demonstrate an understanding of functions, the student will be able to:
1. Definition	1. Define a function;
2. Domain	2. Define and/or determine the domain of a function;
3. Range	3. Determine the range of a function;
4. Functional notation	4. Find elements of the range of a function by using functional notation.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
*XII. Real Numbers, Radicals, and Quadratics	
*A. Real numbers	*A. To demonstrate an understanding of real numbers, the student will be able to define and/or identify the listed mathematical terms.
1. Terminating decimals	
2. Repeating decimals	
3. Rational numbers	
4. Irrational numbers	
5. Principal square root	
*B. Radical expressions	*B. To demonstrate an understanding of radicals, the student will be able to:
1. Properties of radicals	1. Identify and use the multiplication and division properties of radicals;
2. Simplifying radicals	2. Simplify radical expressions;
3. Computations with radicals	3. Perform operations on radicals that involve:
a. Multiplication and division	a. Multiplication and division
b. Addition and subtraction	b. Addition and subtraction
c. Rationalize the denominator	c. Rationalizing the denominator of fractions
*C. Quadratic equations	*C. To demonstrate an understanding of quadratic equations, the student will be able to:
1. Solution of quadratic equations	1. Solve quadratic equations by:
a. Factoring	a. Factoring
b. Completing the square	b. Completing the square
c. Quadratic formula	c. Using the quadratic formula

*Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
Real Numbers, Radicals, and Quadratics (Continued)	
2. Applications	2. Solve verbal problems whose solutions involve quadratic equations.
*D. Radical equations	*D. To demonstrate an understanding of radicals, the student will be able to solve radical equations.
*E. Quadratic inequalities	*E. To demonstrate an understanding of inequalities, the student will be able to solve quadratic inequalities.

*Optional

ACTIVITIES

ACTIVITIES

I. A. **CONTENT:** Language of Mathematics; Identification of Symbols

OBJECTIVE: The student will be able to identify mathematical symbols

ACTIVITIES: Identify the mathematical symbols used in each of the following:

(a) $3 + 4 = 7$

(b) $4 - 2$

(c) 3×5

(d) $4 \div 2$

(e) $12 > 10$

(f) $5 \geq 4$

(g) $4 < 8$

(h) $7 \leq 10$

(i) $(3 + 7) \div 5$

(j) $\{9 - 2\} \div 7$

I. B.(1,2) **CONTENT:** Language of Mathematics; Set of Real Numbers

OBJECTIVE: The student will be able to define and identify:

(a) Real numbers

(b) Subsets of the real numbers

ACTIVITIES: Match letters to numbers

Let A = {natural numbers}	1. {All numbers on the number line}
B = {whole numbers}	2. {0, 1, 2, 3, . . .}
C = {integers}	3. {...,-2,-1,0,1,2,...}
D = {rational numbers}	4. {1,2,3,...}
E = {irrational numbers}	5. $\{-1, -\frac{1}{2}, 0, \frac{7}{16}, .68, 103\}$ 103}
F = {real numbers}	6. $\{\sqrt{2}, .010010001....\pi\}$

Activities (Continued)

I.C. CONTENT: Language of Mathematics; Number Line

OBJECTIVE: The student will be able to:

(a) Construct a number line;

(b) Graph various subsets of the real numbers;

(c) Compare real numbers.

ACTIVITIES: Supply the missing symbols (<, >, =) to make a true statement.

(a) (7) ___?___ (10)

(b) (-3) ___?___ (5)

(c) (-3) ___?___ (-2)

(d) (-7) ___?___ (-12)

(e) (0) ___?___ (-2)

(f) (6) ___?___ (-6)

(g) $-(-\frac{1}{2})$ ___?___ $\frac{1}{2}$

I.C (4) CONTENT: Language of Mathematics; Number Line; Absolute Value

OBJECTIVE: The student will be able to define and determine the absolute value of a real number

ACTIVITIES: Supply the missing details

(a) $|-7| =$ ___?___

(b) $|8 - 4| =$ ___?___

(c) $|17| =$ ___?___

(d) $|-7| - |-2| =$ ___?___

(e) $-|-6| =$ ___?___

(f) $|n| =$ ___?___ if $n < o$

(g) $|n| =$ ___?___ if $n < o$

(h) $|-n| =$ ___?___ if $n < o$

II.A. CONTENT: Operations on Real Numbers; Order of Operations

OBJECTIVE: The student will be able to:

(a) Perform multiple operations without grouping symbols;

(b) Perform multiple operations with grouping symbols.

ACTIVITIES:

(a) Perform the indicated operations.

(1) $5 + 3 \times 7$

(2) $15 - 6 \times 2$

(3) $16 \div 8 \times 2$

(4) $24 \div 2 \times 3 + 6 \times 2 \div 3$

(5) $36 \div 8 - 3 + 6 \div 2$

(b) Perform the indicated operations.

(1) $3 \times (6 - 2) + 5$

(2) $12 - (3 - \frac{1}{2})$

(3) $36 \div (9 \times 2)$

(4) $24 \div (2 \times 3) + 6 \times (2 \div 3)$

(5) $48 \div (2 - 6) + 4 \times (8 \div 2)$

(6) $2\ \{3(4-2) + 18 \div (2 \times 3)\}$

II.B.(1,2) CONTENT: Operations on Real Numbers; Addition of Real Numbers

OBJECTIVE: The student will be able to:

(a) Use a number line to add real numbers;

(b) Develop and use the rules for adding real numbers.

ACTIVITIES:

(a) Draw a number line and use it to add each of the following.

(1) (+3) + (+2)

(2) (-7) + (+2)

(3) (-8) + (-4)

(4) (+7) + (-5)

(b) Use the rules for addition to add the following.

(1) (+3) + (+7)

(2) (+7) + (-8)

(3) (-16) + (-12)

(4) (-15) + (+32)

(5) (+2) + (-8) + (-7) + (+3)

(6) $(-\frac{1}{2}) + (+\frac{2}{3})$

II.C. CONTENT: Operations on Real Numbers; Subtraction of Real Numbers

OBJECTIVE: The student will be able to subtract real numbers by using the definition of subtraction.

ACTIVITIES:

(a) Perform the indicated operations.

(1) 7 - 5 =

(2) -6 - 3 =

(3) -6 - (-2) =

(4) -36 - (+4) =

(5) -5 - 4 + 2 - (-3) + 7 =

(b) Subtract.

(1) $\begin{array}{r} +8 \\ +6 \\ \hline \end{array}$

(2) $\begin{array}{r} -8 \\ +3 \\ \hline \end{array}$

(3) $\begin{array}{r} -16 \\ -12 \\ \hline \end{array}$

(4) $\begin{array}{r} 16 \\ -12 \\ \hline \end{array}$

II.D CONTENT: Operations on Real Numbers; Multiplication of Real Numbers

OBJECTIVE: The student will be able to multiply real numbers.

ACTIVITIES:

Find the product.

(a) $(-5)(+4)$

(b) $(-6)(-2)$

(c) $(+6)(+3)$

(d) $(-\frac{1}{2})(+\frac{2}{3})$

(e) $(-1)(+5)(-2)(+3)$

(f) $(-\frac{1}{4})(\frac{3}{5})(-25)(-16)$

II.E CONTENT: Operations on Real Numbers; Division of Real Numbers

OBJECTIVE: The student will be able to divide real numbers.

ACTIVITIES:

Find the Quotient.

(a) $\frac{+5}{-5}$

(b) $\frac{+8}{-2}$

(c) $\frac{-6}{-3}$

(d) $\frac{4}{-8}$

(e) $\frac{(+6)(-2)}{(-3)(-1)}$

(f) $\frac{(-4)(-8)}{(-1)(-3)(-4)}$

II.F. CONTENT: Operations on Real Numbers; Axioms of Real Numbers

OBJECTIVE: The student will be able to recognize and use the axioms of real numbers.

ACTIVITIES:

(a) Name the axiom that justifies each of the following:

(1) $3 + 2 = 2 + 3$

(2) $(2)(3) = (3)(2)$

(3) $4(5 + 2) = 4(5) + 4(2)$

(4) $7 + 0 = 7$

(5) $6(3) + 6(5) = 6(3 + 5)$

(6) $(4)(5.6) = (4.5)6$

(7) $3 + (-3) = 0$

(8) $5.1 = 5$

(9) $(-1)(3) = -3$

(10) $(8)(0) = 0$

(11) $(3 + 4) + 2 = 3 + (4 + 2)$

(12) $\frac{2}{3} \cdot \frac{3}{2} = 1$

(13) $(4 + 3) + 2 = (3 + 4) + 2$

(14) $4(5 + 2) = 4(2 + 5)$

(15) $4(5 + 2) = (5 + 2)\ 4$

(b) Name the axiom that justifies each step.

(1) $(a + b) + c = a + (b + c) = a + (c + b)$

(2) $5\ (7c) = (5 \cdot 7)\ c = 35c$

(3) $6 + (2 + c) = (6 + 2) + c = 8 + c$

(4) $5\ (c + 0) = 5 \cdot c + 5 \cdot 0 = 5c + 0 = 5c$

III.A. CONTENT: Language of Algebra; Algebraic Expressions; Evaluation

OBJECTIVE: The student will be able to:

(a) Define and identify the listed mathematical terms;

(b) Evaluate algebraic expressions given a replacement set for the variable.

ACTIVITIES: (a) Evaluate each expression for the given values of the variable.

(1) $2x + 5$; $x = 2$

(2) $5(a - 1)$; $a = -2$

(3) $2a - 3b$; $a = 5$, $b = -2$

(4) $a^2 - 2b^2$; $a = 3$, $b = -2$

(5) $\frac{x + 2y}{3x}$; $x = 7$, $y = -2$

(6) $(x + y)^2$; $x = 4$, $y = 3$

(7) $x^2 + y^2$; $x = 4$, $y = 3$

(8) $\frac{ab^2}{2} + 3a$; $a = -2$, $b = 4$

(b) Find all values of each expression given that the replacement set for x is {1, 3, -2} and the replacement set for ys is {-2, -1}

(1) $2x - 3y$

(2) $x^2 - y^2$

III.B. (1,2) CONTENT: Language of Algebra; Linear Equations; Definitions and Axioms

OBJECTIVE: The student will be able to:

(a) Define and identify the listed mathematical terms;

(b) Use the axioms of equality.

ACTIVITIES: Identify each of the following as reflexive, symmetric or transitive.

(a) $3 = 3$

(b) If $a = b$ and $b = 5$, then $a = 5$

(c) If $10 = c$, then $c = 10$

(d) If $a + 2 = b$, and $a + 2 = c$, then $b = c$

III.B. (3,4) CONTENT: Language of Algebra; Linear Equations; Other Properties of Equality; Solving Linear Equations in One Variable

OBJECTIVE: The student will be able to use the properties of equality to solve linear equations in one variable.

ACTIVITIES:

Find the solution set of each of the following.

(a) $x - 6 = 10$

(b) $24 = 2x$

(c) $10y + 6 = -84$

(d) $32 - x = 14$

(e) $\frac{3}{4}x = 12$

(f) $-\frac{2}{3}x = 18$

(g) $-\frac{3}{4} = \frac{5}{2}$

(h) $\frac{3m}{2} + \frac{7}{2} = 11$

(i) $-18 = \frac{2}{3}x - 12$

(j) $8 - 3x = 20$

(k) $3z + 12 = 0$

III.B.(5) CONTENT: Language of Algebra; Linear Equations; Solving Compound Sentences

OBJECTIVE: The student will be able to use the properties of equality to solve compound sentences that involve absolute vlaue.

ACTIVITIES:

Find the solution set.

(a) $|y| = 7$

(b) $|-a| = 6$

III.C.(1, 2, 3, 4)

CONTENT: Language of Algebra; Linear Inequalities; Definitions and Properties

OBJECTIVE: The student will be able to:

(a) Define and identify a linear inequality;

(b) Use the properties of inequalities to solve and graph the solution set of linear inequalities.

ACTIVITIES:

Solve each inequality and graph the solution set on a number line.

(a) $x - 2 > 4$

(b) $5y + 3 \geq 18$

(c) $2 - 3s < 11$

(d) $-3p < -12$

(e) $5 \leq -3x - 13$

(f) $\frac{1}{2}x \leq -\frac{3}{4}$

(g) $-3 < \frac{2}{3}p - 1$

(h) $4(\frac{1}{4} + \frac{x}{2}) > 1$

(i) $3(x - 2) < 3x + 12$

(j) $2(x - 5) > 2x + 6$

III.C.(5, 6)

CONTENT: Language of Algebra; Solving Compound Sentences Involving Inequalities; Graphs

OBJECTIVE: The student will be able to:

(a) Use the property of inequalities to solve compound sentences that involve inequalities;

(b) Graph the solution set of compound sentences that involve inequalities.

ACTIVITIES:

Solve each compound sentence and graph the solution set on a number line.

(a) $1 \leq y + 7 < 6$

(b) $-15 < 4b - 5 < -9$

(c) $6m - 3 > 9$ or $6m - 3 < -9$

(d) $-4 + n < +3$ and $2 + n > 3$

(e) $5 - 2x > 7$ or $3x < 9$

(f) $x - 1 > -1$ and $x - 2 \leq 0$

(g) $-8 \leq -1 + 3a < 11$

(h) $2x > 6$ and $3x > -6$

*(i) $| x - 4 | > 2$

*(j) $| x + 2 | \leq 3$

* Optional

IV.A. CONTENT: First Degree Equations and Inequalities; Linear Equations

OBJECTIVE: The student will be able to solve first degree equations that have variables in both members of the equations.

ACTIVITIES:

(a) Solve for x.

(1) $7x = 10 + 2x$

(2) $x = 4x + 30$

(3) $8x + 17 = 5x + 35$

(4) $12x - 5 = 8x - x + 50$

(5) $\frac{2x}{3} - \frac{1}{2} = \frac{2x + 5}{6}$

(6) $.8x = .2x + 36$

(7) $\frac{17}{2} x = \frac{39}{2} + 22$

*(8) $4x - 2d = 3d$

*(9) $cx = 2m$

*(10) $abx = a^2b^2 - a^3b$

(b) Remove the parentheses and solve for x.

(1) $2x - (x + 6) = 10$

(2) $7x - (4x - 39) = 3$

(3) $3(x - 5) = 2(2x + 1)$

(4) $2(x + 1) - 3(2x + 3) = 3x$

(5) $2\{5x - 2(x - 3)\} = 3x + 7$

(6) $(x + 2)(x - 3) - 2x = (x + 5)(x - 3)$

IV.B. CONTENT: First Degree Equations and Inequalities; Inequalities in One Variable

OBJECTIVE: The student will be able to solve inequalities that contain variables in both members of the inequality.

ACTIVITIES:

Find the solution set.

(a) $2x - 6 < x + 3$

* Optional

(b) $3(x + 2) > 4x$

(c) $\frac{4x + 1}{6} + \frac{3x}{4} \geq \frac{2x - 4}{3}$

(d) $3(x - 4) - 2(2x - 3) \leq -3(x + 6)$

(e) $(2x - 1)(x + 3) - 5x > (x + 2)(x - 5) + x^2$

IV.C. CONTENT: Language of Algebra; Algebraic Expressions

OBJECTIVE: The student will be able to:

(a) Translate verbal expressions to algebraic expressions;

(b) Translate algebraic expressions to verbal expressions.

ACTIVITIES:

Translate each word phrase into an algebraic expression.

(a) The sum of b and 8

(b) x diminished by y

(c) The product of s and t

(d) 12 increased by 8

(e) 5 less than d

(f) 5 more than twice c

(g) 6 less than two times m

(h) Seven diminished by the sum of 2 and c

(i) Five times the sum of 2 and y

(j) The square of the product of 3 and x

(k) The square of the sum of 3 and x

IV.D. CONTENT: First Degree Equations and Inequalities; Applications

OBJECTIVE: The student will be able to use linear equations to solve problems that involve number relations, consecutive integers, geometry, money, age and distance.

ACTIVITIES:

(a) Number problems

(1) The sum of twice a number and 16 is 86. Find the number.

(2) Seventeen less than twice a number is 109. Find the number.

(b) Consecutive integer problems

(1) The sum of two consecutive integers is 35. Find the integers.

(2) The sum of three consecutive odd integers is 105. Find the integers.

(3) Find three consecutive odd integers so that five times the greatest decreased by six times the least is nine.

(c) Geometry problems

(1) The sum of the length and width of a rectangle is 42 cm. If twice the length is one cm less than three times the width, find the dimensions of the rectangle.

(2) The base of a triangle has the same length as a side of a square. The other two sides of the triangle are 2 cm and 6 cm longer than the base. If the perimeter of the square equals the perimeter of the triangle, find the lengths of the sides of the triangle.

(d) Distance problems

(1) Two trains leave the same station at the same time and travel in opposite directions. If their rates are 50 mph and 60 mph, in how many hours will they be 660 miles apart?

(2) A salesman made a 375 mile-trip by traveling 3 hours by bus and 4 hours by train. The train's average speed was 15 mph more than the speed of the bus; find the rates of each.

(e) Coin problems

(1) Hilda has $2.15 in dimes and quarters. If she has four more dimes than quarters, how many dimes does she have?

(2) A soft drink machine takes nickels, quarters and dimes. If a week's receipt of $21.20 contained 17 more dimes than quarters and 24 less nickels than quarters, how many nickels did the machine contain?

(f) Age problems

(1) Bob is twice as old as Emma and Emma is 16 years younger than Tom. If the sum of their ages is 60 years, what is the age of each.

(2) Jack's father is 4 times as old as Jack is now. In 5 years Jack's father will be 3 times as old as Jack is then. How old is Jack now?

V.A. (1,2) CONTENT: Polynomials; Introduction to Polynomials

OBJECTIVE: The student will be able to:

(a) Define and identify the listed mathematical terms;

(b) Write the terms of a polynomial in descending or ascending order.

ACTIVITIES: (a) Identify each polynomial as either a monomial, binomial or trinomial. Determine the numerical coefficient of each term and find the degree of the polynomial.

(1) $2x^3 + 6$

(2) $3x - 6x^2 + 8$

(3) $x^3 - x^4 + x$

(4) $6x^5 + x^3$

(5) 7

(6) $-5x + 6$

(b) Write each of the polynomials in descending order.

(1) $5x^2 + 6x^3 + 4x - 5$

(2) $x^2 - 6 + 3x^8 - 7x^4$

(3) $p^3 - 1 + 2p^5 - p^4 + 2 - p^2$

(4) $-3c^4 + 4d^3 + 3c^2d^2 - 5 + 2c^3d$

V.B.(1) CONTENT: Polynomials; Operations on Polynomials; Addition

OBJECTIVE: The student will be able to add polynomials by combining similar terms.

ACTIVITIES: Perform the indicated operations.

(a) $x^3 - 2 + x^2 + 5x^3 - 8 + 7x^2$

(b) $2xy^2 + 3x^2y - 6xy^2 - 5x^2y$

(c) $2x + 4x^2 - 7 + x^2 + 7 - 8x$

(d) $(5x^2 - 2x + 7) + (-4x - 7x^2 - 9)$

(e) $2x^3 + 7 - 3x^2 + (-5x^3 + x^4 - 8x^2)$

(f) $-3a^3b - 2a^2b^2 + 6a^3b - 5ab^2 + 7a^2b^2 + ab^2$

V.B. (2)

CONTENT: Polynomials; Operations on Polynomials; Subtraction

OBJECTIVE: The student will be able to subtract polynomials by using the definition of subtraction and combining similar terms.

ACTIVITIES:

(a) Subtract.

(1) Subtract $5x^2 - 8x - 10$ from $-6x^2 - 3x - 8$

(2) From $3a + 7b + 6c$ subtract $-8a - 2b + 2c$

(3) Subtract $-3x^2 + 5x - 2$ from $x^3 - 4x^2 - 4$

(4) From $8x^3 - 6x + 2$ subtract $2x^2 - 8x - 9$

(b) Simplify.

(1) $5x - (2x - 3)$

(2) $5x^2 - 2x - (-8x^2 - 6x + 7)$

(3) $-9x^3 - (-2x^2 + 3x^3 - 6x) + 3x^2 - 12x + 2$

(4) $3x^2 - \{6x - (-2x - x^2) + 6\} + 4$

V.B. (3a)

CONTENT: Polynomials; Operations on Polynomials; Laws of Exponents; Multiplication of Monomials

OBJECTIVE: The student will be able to use the laws of exponents to multiply monomials.

ACTIVITIES:

(a) Perform the indicated operations.

(1) $(a^3)(a^2)$

(2) $(3x^2)(2y^4)$

(3) $(a^2)(2a^3)(a)$

(4) $(3^5)(3^2)$

(5) $(9xy)(3xy)$

(6) $(-4a^2b)(2ab^3)$

(7) $(2r^4s)(8rs)(r^2s^2)$

(8) $(-\frac{3}{4}a)(8ab)(2a^2b^3)$

(9) $(r^2x)(2r^3s^2)(rs^3)(-r^2s)$

(b) Use the power rule and perform the indicated operations.

(1) $(x^2)^3$

(2) $(x^3)\ (x^3)$

(3) $(-3a)^2$

(4) $(-2a^2)^3$

(5) $3(-2a)^2$

(6) $(2x)^2(-3x)^2$

(7) $(-2x)^2(2x)^2$

(8) $\frac{1}{2}\ n^2)(2n)^2(n^3)^2$

(9) $(6a^2b)(2ab^2)(ab^2)^3$

(10) $(.2a^2)\ (5a^4)^2$

(11) $(3a)^3(2ab)(-ab)^2$

(c) Perform the indicated operations and simplify.

(1) $(2a)^2 - 5a^2$

(2) $(x)(x^2) - (3x)(x)^2$

(3) $3a\ (2ab) - (2b)(-a)^2 + 4\ a^2b$

(4) $(-2a)(5b^2)(3a) + (7a^2)(3b^2) - (4ab)(2ab)$

V.B. (3b)

CONTENT: Polynomials; Operations on Polynomials; Laws of Exponents; Multiplication of a Polynomial by a Monomial

OBJECTIVE: The student will be able to use the laws of exponents to multiply a polynomial by a monomial.

ACTIVITIES:

(a) Find the product.

(1) $-5(x^2 - 3x + 7)$

(2) $2x^2(3x - 2)$

(3) $(-x^3 + 2x^2 - 6x + 5).2x$

(4) $-a^2b\ (2a^3b - 3ab^2 + 2b^2)$

(b) Perform the indicated operations and simplify.

(1) $3(x - 2) - 4$

(2) $6x + 3(2x - 1) + 5$

(3) $3(4x - 3) - 3(2x + 5)$

(4) $8(x^2 - 2x - 3) - (-2x^2 + 3x - 6) + 5(-2x^2 + 6x)$

(5) $3\{5x + 2(2x - 3) - 6\}$

(6) $2x^2 (x^2 - 3x - 6) - 4x (-2x^3 + 5x^2 - 2)$

V.B. (3c) CONTENT: Polynomials; Operations on Polynomials; Laws of Exponents; Multiplication of Polynomials

OBJECTIVE: The student will be able to use the laws of exponents to multiply polynomials.

ACTIVITIES:

(a) Multiply.

(1) $(x + 2)(x - 3)$

(2) $(2x - 3)(4x - 2)$

(3) $(3x - 2y)(6x + 5y)$

(4) $(3x - 2)^2$

(5) $(5x + 2y)(5x - 2y)$

(6) $(-2x + 3)(3x - 5)$

(7) $(2x - 3)(2x^2 - 3x + 4)$

(8) $(x^2 - 5x + 3)(2x^2 + 7x - 2)$

(9) $(7 - 2x^2 + 5)(3 - x^2 + 2x)$

(10) $x(x + 2)(3x - 4)$

(11) $(a - b)(a^2 + ab + b^2)$

(b) Perform the indicated operations and simplify.

(1) $(x + 5)(x - 2) + (2x - 1)(8x + 2)$

(2) $2(3x - 2) - 3(5x + 1)(x - 1)$

(3) $(2x - 3)^2 - (x + 2)^2$

(4) $2(x - 2y)(3x + y) - 4(x + y)(x - 2y)$

V.B. (4a)

CONTENT: Polynomials; Operations and Polynomials; Laws of Exponents; Division of Monomials

OBJECTIVE: The student will be able to use the laws of exponents to divide monomials.

ACTIVITIES:

(a) Find the quotient.

(1) $\frac{x^4}{x^2}$

(2) $\frac{3x^8}{x^3}$

(3) $\frac{x^{10}}{x^{12}}$

(4) $\frac{25x^4y^3}{5\ xy^2}$

(5) $\frac{6x^2y^4}{12x^2y^2}$

(6) $\frac{3^6}{3^4}$

(7) $\frac{-12x^6y^{10}}{24\ x^8y^6}$

(8) $\frac{36x^6y^4z^8}{6x^2y^8z^{10}}$

(9) $\frac{16(x + y)^3}{4(x + y)^2}$

(b) Simplify each expression.

(1) $\frac{16a^5b^2}{(2ab)^3}$

(2) $\frac{(x^2y)^3}{(xy^2)^2}$

(3) $\frac{(2x^4y)^3}{(4x^3y^2)^2}$

(4) $\frac{-(3c^3d^2)^3}{6(c^2d^3)^3}$

(5) $\frac{(2x^2y)(3xy^2)}{(9x^2y^2)(2x^3y)}$

(6) $\frac{(2x^2)^2(-3x)}{(-3x^2)^2(-2x)}$

(7) $\frac{(-3xy^2)^4}{(2x^2y)^2}$

(8) $\frac{(3a)^2(-2ab)^3}{(-ab)^3(6ab)^2}$

V.B. (4b) CONTENT: Polynomials; Operations on Polynomials; Laws of Exponents; Division of a Polynomial by a Monomial

OBJECTIVE: The student will be able to use the laws of exponents to divide a polynomial by a monomial.

ACTIVITIES: Find the quotients.

(a) $\frac{3x - 15}{3}$

(b) $\frac{8b + 4}{-2}$

(c) $\frac{5x^2 + 10x - 15}{5}$

(d) $\frac{x^2 + 8x}{x}$

(e) $\frac{4x^2 - 12x}{-2x}$

(f) $\frac{-12y^3 + 6y^2 - 8y}{-2y}$

(g) $\frac{32a^2b^3 - 16ab^4 + 8ab}{-8ab}$

(h) $\frac{4x^4 - 2x^3 + 8x}{-2x^2}$

V.B. (4c) CONTENT: Polynomials; Operations on Polynomials; Laws of Exponents; Division of Polynomials

OBJECTIVE: The student will be able to use the laws of exponents to divide polynomials.

ACTIVITIES: Find the quotients.

(a) $(x^2 + 6x + 12) \div (x - 4)$

(b) $(2x^2 + 11x - 13) \div (x - 1)$

(c) $6x^2 + 5x - 15) \div (2x + 3)$

(d) $(2x^2 - xy - 6y^2) \div (x - 2y)$

(e) $(15ab + 9b^2 + 6a^2) \div (2a + 3b)$

(f) $(8a^3 + 27) \div (2a + 3)$

(g) $(12x^3 - 17x^2 + 21x - 8) \div (3x - 2)$

(h) $(6x^3 - 30x + 14x^2 + 12) \div (2x^2 + 6x - 6)$

(i) $(x^5 - 1) \div (x - 1)$

VI.A. CONTENT: Factoring Monomials; Prime Factors of Integers

OBJECTIVE: The student will be able to:

(a) Define factors;

(b) Find the prime factors of integers.

ACTIVITIES:

Write each of the following as the product of primes.

(a) 12 (e) 768

(b) 36 (f) 2,000

(c) 250 (g) 328

(d) 726 (h) 1,176

VI.B. CONTENT: Factoring Monomials; Greatest Common Factor

OBJECTIVE: The student will be able to find the greatest common factor of algebraic expressions.

ACTIVITIES: (a) Find the G. C. F. of each pair of integers.

(1) 15, 85 (4) 90, 240

(2) 84, 42 (5) 96, 56

(3) 63, 900 (6) 162, 382

(b) Find the G. C. F. of each of the following.

(1) $2x$, $4x$ (4) $16x^4y^4$, $32x^4y^3$

(2) $16x^2y$, $8xy^3$ (5) $6x^2$, $9x^4y$, $3x^2y^4$

(3) $10x^4y^5$, $7x^3y^8$ (6) $10x^2y^4$, $5xy^3$, $25x^2y^4$

VII.A. CONTENT: Multiplication and Factoring of Polynomials; Multiplying by Sight

OBJECTIVE: The student will be able to multiply binomials by sight.

ACTIVITIES: Multiply each expression by sight.

(a) $(a + 2)(a - 2)$

(b) $(x - 8)^2$

(c) $(2a + 3b)^2$

(d) $(-u - 6)^2$

(e) $(x + y)(x + 2y)$

(f) $(x - 5)(x + 2)$

(g) $(5h - 3)(2h + 5)$

VII.B. CONTENT: Multiplication and Factoring of Polynomials; Factoring

OBJECTIVE: The student will be able to factor special types of polynomials.

ACTIVITIES: (a) Write each expression in factored form.

(1) $2x - 4$

(2) $3x^2 - 6x$

(3) $2ax^2 - 4ax + 8a$

(4) $12c^2 - c$

(5) $5r^2s - 10rs^2$

(6) $x^3 - x^2$

(b) Factor.

(1) $x^2 - 9$

(2) $x^2 - y^2$

(3) $x^4 - y^4$

(4) $-9 + 4r^2s^2$

(c) Factor each trinomial square.

(1) $h^2 + 4h + 4$

(2) $36 - 12u + u^2$

(3) $25x^2 + 10x + 1$

(4) $4x^2 + 20xy + 25y^2$

(d) Factor each trinomial.

(1) $x^2 + 7x + 12$

(2) $x^2 - 8x + 7$

(3) $x^2 - 6x - 7$

(4) $3x^2 + 10x + 8$

(5) $3x^2 - 5x - 12$

(6) $x^2 + 14xy + 24y^2$

(7) $18x^2 - 23xy - 6y^2$

(8) $15 - 8x + x^2$

(9) $2 + 7x - 15x^2$

(e) Factor completely.

(1) $2x^2 - 8$

(2) $2w^4 - 162$

(3) $x^3 - 3x^2 - 4x$

(4) $3x^2 + 21xy + 9y^2$

(5) $18x^2 + 6xy - 4y^2$

(6) $x^4 - 13x^2 + 36$

(7) $x^3 - x^2 - 4x + 4$

VII.C. (1) CONTENT: Multiplication and Factoring of Polynomials; Quadratic Equations; Solutions by Factoring

OBJECTIVE: The student will be able to solve quadratic equations by factoring.

ACTIVITIES: Find the solution set.

(a) $x^2 - x = 6$

(b) $x^2 = 6x$

(c) $2x^2 = 8$

(d) $9x^2 - 6x + 1 = 0$

(e) $20x^2 = 22x - 6$

(f) $4x = x^2$

(g) $10x^2 = 75 - 35x$

*VII.C. (2) CONTENT: Multiplication and Factoring of Polynomials; Quadratic Equations; Applications

OBJECTIVE: The student will be able to solve verbal problems by using quadratic equations.

ACTIVITIES:

(a) The length of a rectangle exceeds its width by 5 inches. If the area of the rectangle is 176 sq. inches, find the dimensions of the rectangle.

(b) If the perimeter of a rectangle is 80 ft. and its area is 384 sq. ft., find its length and width.

* Optional

VIII.A. CONTENT: Factoring; Common Fractions

OBJECTIVE: The student will be able to perform fundamental operations on common fractions.

ACTIVITIES:

(a) Add.

(1) $\frac{5}{6}$

$\underline{+\frac{2}{3}}$

(2) $1\frac{1}{4}$

$\underline{+2\frac{7}{8}}$

(3) $76\frac{1}{10}$

$\underline{+28\frac{3}{8}}$

(b) Subtract.

(1) $38\frac{3}{4}$

$\underline{-25\frac{1}{8}}$

(2) $56\frac{1}{9}$

$\underline{-28\frac{5}{8}}$

(3) $8\frac{5}{24}$

$\underline{-2\frac{1}{18}}$

(c) Find the product.

(1) $(2\frac{1}{3})\ (1\frac{1}{3})$

(2) $(1\frac{2}{5})\ (3\frac{1}{3})$

(d) Find the quotient.

(1) $(2\frac{4}{5})\ (\frac{3}{5})$

(2) $(3\frac{1}{3})\ (2\frac{2}{5})$

VIII.B. (1, 2) CONTENT: Fractions; Algebraic Fractions; Definitions and Restrictions

OBJECTIVE: The student will be able to:

(a) Define an algebraic fraction;

(b) Determine the restricted values of an algebraic fraction.

ACTIVITIES:

For what values of x are the fractions not defined?

(a) $\frac{1}{5x}$

(b) $\frac{x}{x - 2}$

(c) $\frac{x^2 + 4}{x^2 - 4}$

(d) $\frac{2}{x^2 - x}$

(e) $\frac{3}{x^2 + 9}$

(f) $\frac{3x}{x^2 - x - 6}$

VIII.B. (3) CONTENT: Fractions; Algebraic Fractions; Reducing Fractions

OBJECTIVE: The student will be able to reduce algebraic fractions.

ACTIVITIES:

Reduce

(a) $\frac{24x}{3xy}$

(b) $\frac{3x^2y}{6xy^2}$

(c) $\frac{a^2 - 9}{a - 3}$

(d) $\frac{x^2 - 9}{x^2 - x - 6}$

(e) $\frac{ax - ay}{bx - by}$

(f) $\frac{18x^2 - 32y^2}{6x^2 - xy - 12y^2}$

VIII.B. (4, 5) CONTENT: Fractions; Algebraic Fractions; Multiplication and Division

OBJECTIVE: The student will be able to:

(a) Multiply algebraic fractions;

(b) Divide algebraic fractions.

ACTIVITIES:

(a) Find the product.

(1) $\frac{-6rs}{5} \cdot \frac{10r}{3r^2s}$

(2) $\frac{x^2 - y^2}{5} \cdot \frac{5}{x-y}$

(3) $\frac{x^2 - 9}{x^2 - x} \cdot \frac{x^2 - 1}{x - 3}$

(4) $\frac{x^2 - 3x - 18}{x^2 - 9} \cdot \frac{6 - 2x}{x - 6}$

(b) Find the quotient.

(1) $\frac{3x}{5y} \div \frac{21x^2}{20y}$

(2) $\frac{2x^2 - 18}{x^2 + 6x - 7} \div \frac{8x^2 + 4x - 24}{x^2 - 1}$

(3) $\frac{x^2 - 3x + 2}{x^2 - 1} \div \frac{2 - x}{x - 1}$

(4) $\frac{5c^2 - 5cd}{cd + d^2} \div \frac{d^3 - dc}{cd^2}$

VIII.B. (6) CONTENT: Fractions; Algebraic Fractions; Least Common Multiple

OBJECTIVE: The student will be able to find the least common multiple of two or more algebraic expressions.

ACTIVITIES:

Find the L. C. M. of:

(a) 8 and 12

(b) 6a and 2a

(c) $12x^2y$ and $18\ xy^2$

(d) $x^2 - 1$ and $3x + 3$

(e) $x^2 - 3x + 2$ and $x - 2$

VIII.B. (7) CONTENT: Fractions; Algebraic Fractions; Combining Fractions

OBJECTIVE: The student will be able to combine fractions by addition and subtraction.

ACTIVITIES:

Perform the indicated operations.

(a) $\frac{3}{x} + \frac{5}{x}$

(b) $\frac{2x}{x-1} - \frac{2}{x-1}$

(c) $\frac{3}{xy^2} - \frac{2}{x^2y}$

(d) $\frac{5}{x-y} - \frac{3}{y-x}$

(e) $\frac{3}{2a} - \frac{3-a}{6-a}$

(f) $\frac{6}{a+b} - \frac{4}{3a^2 - 3b^2}$

(g) $\frac{2x+7}{x^2 - 2x - 15} - \frac{3x - 4}{x^2 - 7x + 10}$

*VIII.B. (8)

CONTENT: Fractions; Algebraic Fractions; Mixed Expressions

OBJECTIVE: The student will be able to simplify mixed expressions by adding a polynomial and a fraction.

ACTIVITIES:

Perform the indicated operations.

(a) $5 + \frac{5}{y}$

(b) $a + 1 + \frac{1}{a+1}$

(c) $x - 5 - \frac{x}{x + 3}$

(d) $3 + \frac{2}{3x + 6} + \frac{x - 3}{x^2 - 4}$

*VIII.B. (9)

CONTENT: Fractions; Algebraic Fractions; Complex Fractions

OBJECTIVE: The student will be able to simplify complex fractions.

ACTIVITIES:

Simplify.

(a) $\dfrac{1 + \frac{1}{x}}{1 - \frac{1}{x}}$

(b) $\dfrac{\frac{a - b}{a}}{a - \frac{b}{a}}$

(c) $\dfrac{\frac{1}{a} + \frac{1}{b}}{\frac{a + b}{ab}}$

(d) $\dfrac{\frac{b - 3}{b + 3} - 1}{\frac{b + 3}{b - 3} + \frac{2}{b + 3}}$

VIII.C.

CONTENT: Fractions; Fractional Equations

OBJECTIVE: The student will be able to solve fractional equations.

ACTIVITIES:

Find the solution set.

(a) $\frac{x}{2} + \frac{x}{3} = 40$

* Optional

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(b) $\frac{7x + 5}{8} - \frac{8x + 15}{10} = 2$

(c) $\frac{x + 2}{3x - 6} - \frac{2}{3x + 6} + \frac{7}{9} = 0$

(d) $\frac{2}{3x + 12} - \frac{1}{9x - 3} = \frac{x - 2}{3x^2 + 11x - 4}$

*VIII.D. CONTENT: Fractions; Fractional Inequalities

OBJECTIVES: The student will be able to solve first degree fractional inequalities.

ACTIVITIES:

Find the solution set.

(a) $\frac{x}{9} - \frac{x}{4} > \frac{5}{36}$

(b) $\frac{5x}{2} - x < \frac{3}{2}$

(c) $\frac{5}{x} > \frac{x - 3}{2}$

IX.A,B. CONTENT: Introduction to Squares and Square Roots, Terminology; Squares (Numerals and Variables).

OBJECTIVE: The student will be able to:

(a) Identify the listed mathematical terms;

(b) Find the squares of numerals and variables.

ACTIVITIES: Find the squares of the following numerals and variables.

(a) 5^2

(b) $(3\frac{1}{2})^2$

(c) $(4.5)^2$

(d) $(a^2)^2$

(e) $(a^3)^2$

(f) $(6 \times {}^5y)^2$

(g) $(-6.3)^2$

IX.C.(1) CONTENT: Introduction to Squares and Square Roots; Square Roots

OBJECTIVE: The student will be able to:

(a) Find the square root of a perfect square;

(b) Simplify monomial square roots.

ACTIVITIES:

(a) Find the square root of a perfect square.

(1) $\sqrt{64}$

(2) $\sqrt{625}$

(3) $\sqrt{121}$

(4) $\sqrt{169}$

(5) $\sqrt{x^6}$

(6) $\sqrt{25x^{10}y^{12}}$

(7) $\sqrt{32^2}$

(8) $\sqrt{1/9}$

(b) Simplify monomial square roots.

(1) $\sqrt{20}$

(2) $\sqrt{96}$

(3) $\sqrt{x^7}$

(4) $\sqrt{12x^3}$

(5) $\sqrt{36x^5y^6}$

(6) $\sqrt{\frac{a^3}{64}}$

X.A,B. (1)

CONTENT: Linear Equations and Inequalities; Terminology; Graphing; Location of Points

OBJECTIVE: The student will be able to:

(a) Identify the listed mathematical terms;

(b) Locate and relate points in a plane to ordered pairs of numbers.

ACTIVITIES:

(a) Graph each ordered pair.

(1) (-2,0)

(2) (-3,2)

(3) (6,0)

(4) (2,4)

(5) (0,-2)

(6) (0,-3)

(7) (3,-4)

(b) Which of the points identified in part (a) do not lie in any quadrant?

X.B. (2)

CONTENT: Linear Equations and Inequalities; Graphing; Linear Equations

OBJECTIVE: The student will be able to graph linear equations in two variables.

ACTIVITIES: Draw a coordinate system and graph.

(a) $x = 2$

(b) $y = -3$

(c) $2x + y = 4$

(d) $3x - 2y = -6$

(e) $-5y = -x + 10$

X.B. (3)

CONTENT: Linear Equations and Inequalities; Graphing; Linear Inequalities

OBJECTIVE: The student will be able to graph linear inequalities in two variables.

ACTIVITIES: Draw a coordinate system and graph the solution set.

(a) $x \geq 2$

(b) $y \leq -1$

(c) $x > -1$ and $y < -2$

(d) $x + 2y \leq 6$

(e) $x - 3y > 3$

(f) $2x - y \leq 2$ and $x + y > -4$

X.C.

CONTENT: Linear Equations and Inequalities; Slope of a Line; Computation of Slope

OBJECTIVE: The student will be able to find the slope of a line given:

(a) The graph of the line;

(b) The coordinates of two points of a line;

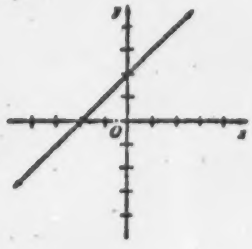
(c) An equation of the line.

ACTIVITIES:

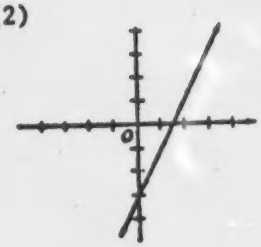
Find the slope of each line.

(a)

(1)



(2)



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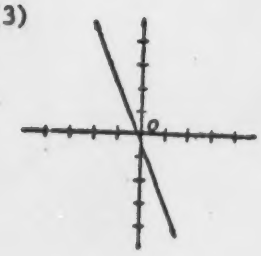

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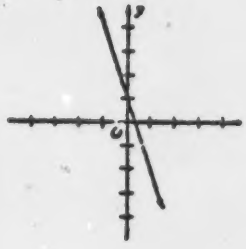

(b) Find the slope of the line that contains:

(1) (7,-1) and (2,3)

(2) (7,-6) and (2,-6)

(3) (5,-2) and (5,4)

(4) (4,1) and (2,-6)

(5) (-8,-2) and (-3,-5)

(c) Write each equation in the form $y = mx + b$. Find the slope of the line and the y-intercept.

(1) $2x + y = 3$

(2) $x + 2y = 13$

(3) $3x - 2y = 6$

(4) $7x - 8y + 15$

(5) $2y = 6$

XD. (1) CONTENT: Linear Equations and Inequalities; Equations of a Line; Slope-Intercept Form

OBJECTIVE: The student will be able to find equations of lines in slope-intercept form.

ACTIVITIES:

(a) Find an equation of the line given that:

(1) $m = 3$; $b = 2$

(2) $m = \frac{2}{3}$; $b = -5$

(3) $m - 0$; $b = -2$

(4) $m = -\frac{3}{5}$; $b = 6$

(b) Find an equation of the line that contains:

(1) (1, 4) and (4, 3)

(2) (0, 5) and (-3, 0)

(3) (-3, -2) and (5, -4)

(c) Find an equation of the line that contains P and has slope m as indicated.

(1) P(2, -2); $m = 3$

(2) P(-3, 5); $m = \frac{2}{3}$

XD. (2) CONTENT; Linear Equations and Inequalities; Equations of a Line; Point-Slope Form

OBJECTIVE: The student will be able to find equations of lines in point-slope form.

ACTIVITIES; (a) Find the slope of the indicated line and the coordinates of a point on the line.

(1) $(y - 2) = \frac{2}{3}(x - 2)$

(2) $3(y - 2) = x - 7$

(b) Find an equation of the line that contains:

(1) (1, 4) and (4, 3)

(2) (-1, 1) and (1, -1)

(3) (2, -3) and (4, -1)

(c) Find an equation of the line that contains P and has the given slope.

(1) $P(-2, 3)$; $m = -4$

(2) $P(-2, 7)$; $m = -\frac{3}{4}$

X. E. (1)

CONTENT: Linear Equations and Inequalities; Systems of Linear Equations; Graphing

OBJECTIVE: The student will be able to solve systems of linear equations by graphing.

ACTIVITIES: Find the point of intersection of the graphs of:

(a) $y = 2x + 4$
$x = y - 5$

(b) $x + y = 3$
$2x - y = -9$

X. E. (2, 3)

CONTENT: Linear Equations and Inequalities; Systems of Linear Equations; Linear-Combination Method

OBJECTIVE: The student will be able to solve systems of linear equations by addition or subtraction.

ACTIVITIES: Find the solution set of each system of equations.

(a) $x + 2y = 8$
$x - 2y = 4$

(b) $a + b = 11$
$3a - 2b = 8$

(c) $5x + 3y = 17$
$4x - 5y = 21$

(d) $3x = 13 - 2y$
$\frac{3y + x}{2} = 8$

*X. E. (4)

CONTENT: Linear Equations and Inequalities; Systems of Linear Equations; Applications

OBJECTIVE: The student will be able to solve verbal problems by using systems of equations.

ACTIVITIES: (a) Digit problems

(1) The tens digit in a two-digit number is 2 more than twice the units digit The sum of the digits is 11. Find the number.

* Optional

(2) The units digit of a two-digit number is 11 less than twice the tens digit. The number is 6 less than 7 times the sum of the digits. Find the number.

(b) Dry Mixture

(1) How many pounds of 90¢ candy must be added to 20 pounds of 75¢ candy to make a mixture of 85¢ candy?

(2) A company has two brands of tea. Brand A is worth $.90 a lb. and Brand B is worth $1.20 a lb. How many lbs. of each brand must be mixed to make a blend of tea that is worth $1.00 a lb.

(c) Distance Problems

(1) A plane that can fly 275 mph in still air flies 3 hours against the wind and two hours with the wind. The total distance it travels is 1,300 miles. Find the wind speed.

(2) A boat travels 18 miles downstream in 2 hours. It requires 6 hours to travel back to the same point upstream. Find the rate of the boat in still water and the rate of the current.

(d) Wet Mixture

(1) A lab technician has solutions of 40% alcohol and 60% alcohol. He needs 100 liters of a solution that is 48% alcohol. How many liters of each solution should he mix?

(2) How many pints of 15% vinegar solution should be added to 10 pints of 20% vinegar solution to yield a solution that is 18% vinegar?

*X.F.

CONTENT: Linear Equations and Inequalities; Systems of Linear Inequalities; Graphing

OBJECTIVE: The student will be able to determine the solution set of two or more linear inequalities by graphing.

ACTIVITIES: Find the solution set of each of the following by graphing.

* Optional

(a) $2x + 3y \geq 6$ and $x + y - 4 \leq 0$

(b) $y - 2x > 2$ or $x + y \leq 2$

(c) $x \geq 4$ and $2x - y < 4$

*XI.A.

CONTENT: Relations and Functions; Relations; Definitions; Domain and Range

OBJECTIVE: The student will be able to:

(a) Define a function;

(b) Recognize a function;

(c) Determine the domain and range of a function.

ACTIVITIES:

Identify the domain and range of the following relations.

(a) $\{(1,2), (-3,4), (-3,2), (0,1)\}$

(b) $\{(x,y) \mid y = 2x, x \text{ any real number}\}$

(c) $\{(x,y) \mid y = x^2, x \text{ any real number}\}$

(d) $\{(x,y) \mid y = |x|, x \text{ any real number}\}$

(e) $\{(x,y) \mid y = 2x + 1, x \text{ any integer}\}$

*XI.B. (1,2,3)

CONTENT: Relations and Functions; Functions; Definitions; Domain and Range

OBJECTIVE: The student will be able to:

(a) Define a function;

(b) Recognize a function;

(c) Determine the domain and range of a function.

ACTIVITIES:

(a) Consider the following relations.

$A = \{(1, 2), (2, 3), (0, 1)\}$

$B = \{(1, 0), (2, 1), (3, 2), (2, 2)\}$

$C = \{(x, y) \mid y = 2x, x \text{ any real number}\}$

$D = \{(x, y) \mid x = y^2, x \text{ a whole number}\}$

(1) Which of the above illustrate functions?

(2) Find the domain and range of each function.

(b) Define a function whose domain is {reals} and whose range is {non-negative reals}

* Optional

*XI.B. (4)

CONTENT: Relations and Functions; Functions; Functional Notation

OBJECTIVE: The student will be able to find elements of the range of a function by using functional notation.

ACTIVITIES:

(a) Given $f(x) = x^2 + 2x$ find

(1) $f(1)$

(2) $f(-3)$

(3) $f(\frac{1}{2})$

(4) $f(p)$

(5) $f(x + 1)$

(6) $f(x^2)$

(b) Given that $f(x) = 2x + 3$ and $g(x) = \frac{x-3}{2}$ find

(1) $f(3)$

(2) $g(2)$

(3) $f\{g(1)\}$

(4) $g\{f(-2)\}$

(5) $f\{g(x)\}$

(6) $g\{f(x)\}$

* Optional

*XII.A.

CONTENT: Real Numbers, Radicals and Quadratics; Real Numbers

OBJECTIVE: The student will be able to define and/or identify the listed mathematical terms.

ACTIVITIES:

(a) Which of the following are true?

(1) Zero is a rational number.

(2) There is no least real number.

(3) The number $\frac{22}{7}$ is not rational.

(4) $\sqrt{2}$ is not real.

(5) .1313... is rational.

(6) .2020020002... is rational.

(b) Name a real number that is not rational.

(c) Name a rational number that is non-negative.

*XII.B. (1)

CONTENT: Real Numbers, Radicals and Quadratics; Radical Expressions; Properties of Radicals

OBJECTIVE: The student will be able to identify and use the properties of radicals.

ACTIVITIES: Perform the indicated operations.

(a) $\sqrt{5} \cdot \sqrt{5}$

(b) $\sqrt{32} \cdot \sqrt{2}$

(c) $(\sqrt{3})^2$

(d) $\frac{\sqrt{48}}{\sqrt{3}}$

(e) $\frac{\sqrt{27}}{\sqrt{3}}$

(f) $(2\sqrt{2})(3\sqrt{8})$

(g) $\frac{\sqrt{75x^3}}{\sqrt{3x}}$

* Optional

*XII.B. (2,3)

CONTENT: Real Numbers, Radicals and Quadratics, Radical Expressions; Computations with Radicals

OBJECTIVE: The student will be able to:

(a) Multiply and divide radical expressions;

(b) Add and subtract radical expressions;

(c) Rationalize the denominator of fractions.

ACTIVITIES:

(a) Perform the indicated operations.

(1) $(\sqrt{9a})(\sqrt{ab})$

(2) $(\sqrt{3a})^2$

(3) $(5\sqrt{3x})^2$

(4) $(3\sqrt{2})(4\sqrt{8})$

(5) $(\sqrt{6xy})(\sqrt{4x^3y^2})$

(6) $(\sqrt{27x})(\sqrt{2x})$

(7) $(4\sqrt{56})(2\sqrt{\frac{1}{2}})$

(8) $\sqrt{18} \div \sqrt{2}$

(9) $3\sqrt{48} \div 2\sqrt{3}$

(10) $\dfrac{\sqrt{8x^3}}{2\sqrt{2x}}$

(b) Perform the indicated operations and simplify.

(1) $8\sqrt{2} + 6\sqrt{2}$

(2) $3\sqrt{8} + 2\sqrt{2}$

(3) $4\sqrt{27} - 2\sqrt{3} + 5\sqrt{12}$

(4) $15\sqrt{x^2y} - 6x\sqrt{4y}$

(5) $3\sqrt{2} + \sqrt{18} + 5\sqrt{8}$

* Optional

(c) Simplify.

(1) $\frac{8}{2\sqrt{2}}$

(2) $\frac{\sqrt{7} - 2}{\sqrt{7}}$

(3) $\frac{4}{\sqrt{3} - 1}$

(4) $\frac{\sqrt{3} + \sqrt{7}}{\sqrt{3} + 2}$

(d) Find the product.

(1) $(3\sqrt{2} - 3)(2\sqrt{2} + 5)$

(2) $(3\sqrt{2} - 2\sqrt{3})^2$

(3) $(5\sqrt{5} + 2\sqrt{2})(5\sqrt{5} - 2\sqrt{2})$

*XII.C. (1) CONTENT: Real Numbers, Radicals and Quadratics; Quadratic Equations; Solutions of Quadratic Equations

OBJECTIVE: The student will be able to solve quadratic equations by:

(a) Factoring;

(b) Completing the square;

(c) Using the quadratic formula.

ACTIVITIES:

(a) Solve by factoring.

(1) $x^2 = 16$

(2) $2x^2 = 6x$

(3) $x^2 - 8x + 12 = 0$

(4) $y^2 - y = 72$

(5) $10x^2 + 11x = 6$

(6) $x^2 - 20 = 0$

* Optional

(b) Solve for x.

(1) $(x - 1)^2 = 4$

(2) $(x + 2)^2 = 8$

(3) $(x - \frac{3}{2})^2 = \frac{25}{4}$

(4) $(x + \frac{5}{4})^2 = \frac{75}{16}$

(c) Solve by completing the square.

(1) $x^2 + 2x = 8$

(2) $3x^2 = 5x + 2$

(3) $x^2 - 2x - 4 = 0$

(d) Solve the exercises of part (a) and part (c) by using the quadratic formula.

*XII.C. (2) CONTENT: Real Numbers; Radicals and Quadratics; Quadratic Equations; Applications

OBJECTIVE: The student will be able to solve verbal problems whose solutions involve quadratic equations.

ACTIVITIES:

Solve the following.

(a) The square of a certain number exceeds the number by 72. Find the number.

(b) If 5 times the square of a number is decreased by twice the number, the result is 16. Find the number.

(c) The length of a rectangle is twice its width. If the area of the rectangle is 72 square inches find the dimensions of the rectangle.

*XII.D. CONTENT: Real Numbers; Radicals and Quadratics; Radical Equations

OBJECTIVE: The student will be able to solve radical equations.

ACTIVITIES: Solve for x

(a) $4\sqrt{3x} = 9$

(b) $\sqrt{x+3} = 5$

(c) $\sqrt{2x - 4} = 10$

(d) $\sqrt{2x - 4} + \sqrt{x} = 2$

* Optional

*XII.E.

CONTENT: Real Numbers, Radicals and Quadratics; Quadratic Inequalities

OBJECTIVE: The student will be able to solve quadratic inequalities.

ACTIVITIES: Find the solution set.

(a) $x^2 - 5x + 6 > 0$

(b) $2x^2 - 9x + 10 \leq 0$

(c) $x^2 + 7x < 0$

* Optional

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